UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
1445 ROSS AVENUE, SUITE 1200
DALLAS, TEXAS 75202 – 2733

February 7, 2019

Mr. Miguel Montoya
Quality Assurance Officer
New Mexico Environment Department
Surface Water Quality Bureau
P.O. Box 5469
Santa Fe, NM 87502-5469

Dear Mr. Montoya:

We have reviewed the Quality Assurance Project Plan (QAPP) entitled "*Upper Rio San Antonio Water Quality Improvement Project on the Carson National Forest"* for Clean Water Act 319 Cooperative Agreement C6-996101-17. I am pleased to inform you that it was approved on February 6, 2019.

This new QAPP will expire on March 31, 2021. Should there be any changes to the QAPP at any time, please submit a revised document to EPA for approval. If the project continues under a new cooperative agreement and there are no substantive technical or programmatic changes, please submit a letter stating that no changes are needed. The letter or revised document is due at least 60 days prior to the expiration date.

Attached is the completed QAPP signature page for your records. In any future correspondence relating to this QAPP, please reference QTRAK #19-121. If you have any questions, you may contact me at (214) 665-2773.

Sincerely,

Leslie C. Rauscher

Leslie Rauscher
Project Officer
State/Tribal Programs Section

Attachment; sent via email, no hardcopy to follow.

New Mexico Environment Department

Surface Water Quality Bureau

Quality Assurance Project Plan

for

Rio San Antonio Water Quality Improvement Project
Rio San Antonio on the Carson National Forest – Tres Piedras Ranger District, NM

Section 319 Grant 2017
Contract No. 18-667-2060-0009

Submitted to:

New Mexico Environment Department
Surface Water Quality Bureau
1190 Saint Francis Drive
Santa Fe, NM 87502

Submitted by:

WildEarth Guardians
516 Alto Street
Santa Fe, NM 87501

APPROVAL PAGE

QUALITY ASSURANCE PROJECT PLAN
for
Rio San Antonio Water Quality Improvement Project

Approvals:

New Mexico Environment Department Surface Water Quality Bureau

Alan Klatt, Project Officer, Watershed Protection Section — Date: 1-8-19

Abe Franklin, Program Manager, Watershed Protection Section — Date: 1/8/2019

Miguel Montoya, Quality Assurance Officer, Standards, Planning and Reporting Team — Date: 1/8/2019

United States Environmental Protection Agency Region VI

Leslie Rauscher, Project Officer, WQPD, EPA Region 6 — Date: 2/6/19

Curry Jones, Chief State & Tribal Programs Section, WQPD, EPA Region 6 — Date: 2/6/19

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ACRONYMS

CNF	Carson National Forest
CWA	Federal Water Pollution Control Act as amended 1972 (aka “Clean Water Act”)
DQO	Data Quality Objective
EPA	United States Environmental Protection Agency
HQCWAL	High Quality Cold Water Aquatic Life Use
NAWCA	North American Wetlands Conservation Act
NMED	New Mexico Environment Department
QAPP	Quality Assurance Project Plan
QA	Quality Assurance
QAO	Quality Assurance Officer
QC	Quality Control
QAPP	Quality Assurance Project Plan
RERI	River Ecosystem Restoration Initiative
SOP	Standard Operating Procedures
SWQB	New Mexico Environment Department Surface Water Quality Bureau
TMDL	Total Maximum Daily Load
USFS	United States Forest Service
WEG	WildEarth Guardians
WPS	Watershed Protection Section, Surface Water Quality Bureau
WQPD	Water Quality Protection Division

1.0 PROJECT MANAGEMENT

1.1 Distribution List

The distribution list, project roles and responsibilities for this project are outlined below in Table 1. The Quality Assurance Officer (QAO) will ensure that copies of this QAPP and any subsequent revisions are distributed to individuals who have signature authority to approve this QAPP. The SWQB 319 Project Officer will ensure that copies of the approved QAPP and any subsequent revisions are distributed to all other project personnel listed in Table 1. All members of the distribution list who do not have signature authority to approve this QAPP will review the QAPP and sign the Acknowledgment Statement prior to initiating any work for this project. The signed Acknowledgement Statements (electronic or hard copy) will be collected by the SWQB Project Officer and will be given to the QAO for filing with the original EPA approved QAPP.

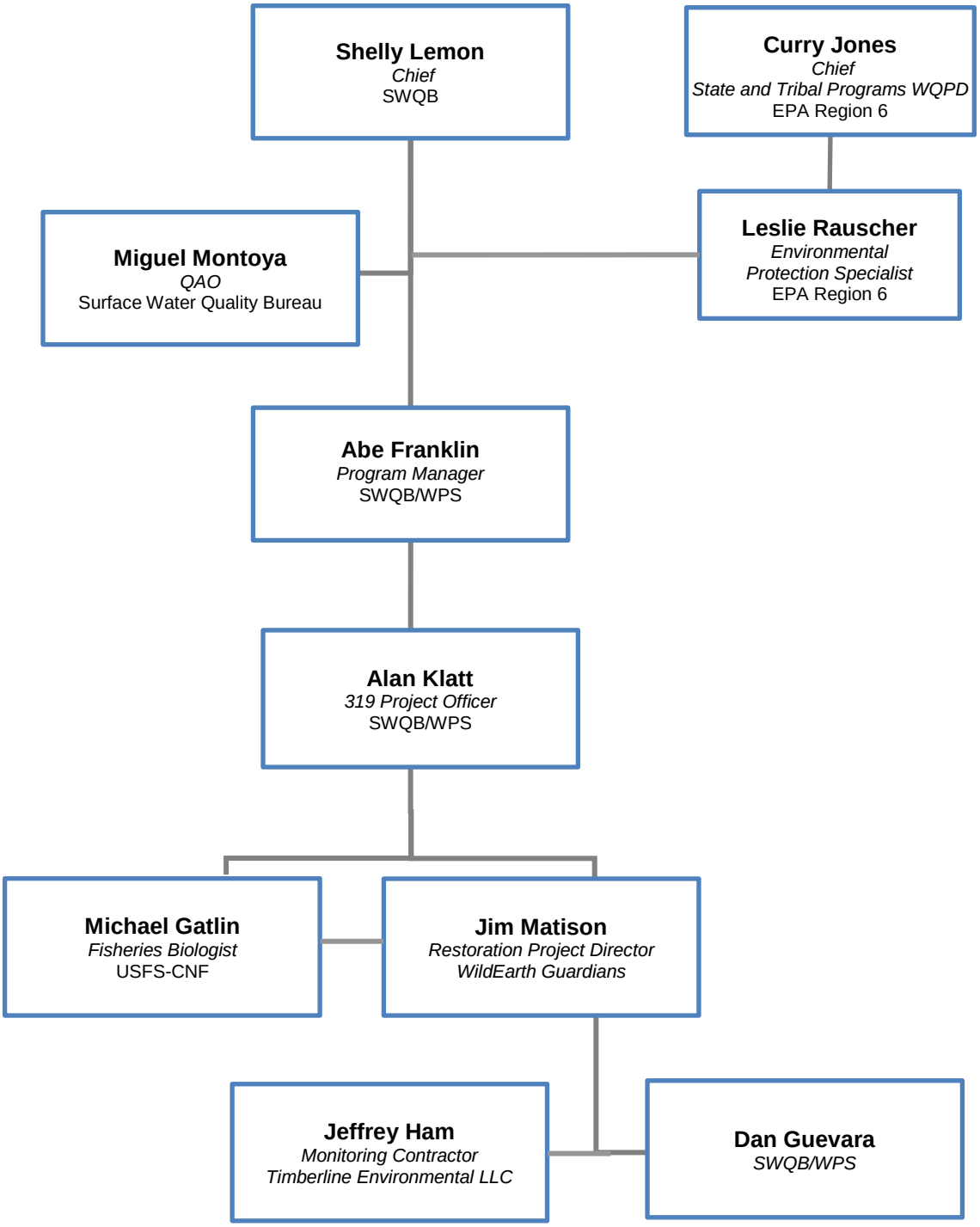
Table 1
Distribution List and Project Roles and Responsibilities

Name	Organization	Position/Role	Responsibility for	Contact Information
Abe Franklin	SWQB	WPS Program Manager	Reviewing and approving QAPP; managing project personnel and resources	(505) 827-2793 abraham.franklin@state.nm.us
Miguel Montoya	SWQB	Quality Assurance Officer	Reviewing and approving QAPP	(505) 826-3794 miguel.montoya@state.nm.us
Alan Klatt	SWQB	319 Project Officer	Assist in QAPP preparation, report preparation; act as liaison between cooperators and project coordinator; and maintain project files.	(505) 827-0388 alan.klatt@state.nm.us
Daniel Guevara	SWQB	Environmental Scientist	Technical assistance for monitoring and data collection	(505) 920-2216 daniel.guevara@state.nm.us
Michael Gatlin	USFS-CNF	Fisheries Biologist	Provide administrative and landowner support, assist in data collection	(575-758-6252 mrgatlin@fs.fed.us
Jim Matison	WildEarth Guardians	Restoration Project Director	Provide data, assist in data collection	(505) 765-1131 jmatison@wildearthguardians.org
Jeffrey Ham	Timberline Environmental LLC	Monitoring Contractor	Provide, collect, and report data	(505) 699-4301 jeffrey.l.ham@gmail.com
Leslie Rauscher	EPA	Environmental Protection Specialist	Review and approve QAPP	(214) 665-2773 rauscher.leslie@epa.gov
Curry Jones	EPA	Chief, State and Tribal Programs Section	Review and approve QAPP	(214) 665-6793 jones.curry@epa.gov

1.2 Project Organization

The SWQB Quality Management Plan (NMED/SWQB 2018) documents the independence of the QAO from this project. The QAO is responsible for maintaining the official approved QAPP. A project organizational chart (Figure 1) displays hierarchy of the project.

Figure 1
Organization Chart
Rio San Antonio Water Quality Improvement Project



1.3 Problem Definition/Background

The purpose of this Quality Assurance Project Plan (QAPP) is to document the results of the Rio San Antonio Water Quality Improvement Project both pre-and post-project implementation.

Background of the Rio San Antonio Water Quality Improvement Project

The Rio San Antonio (Montoya Canyon to headwaters, 17.92 miles, Assessment Unit: NM-2120.A_901) is listed under the Clean Water Act 2014 – 2016 303(d)/305(b) Integrated Report[1]. The state lists the segment as being temperature, *Escherichia coli* (*E. coli*), and nutrient impaired, which cause the stream to not meet its designated use for High Quality Cold Water Aquatic Life (HQCWAL). The Integrated Report lists the possible sources of impairment as waterfowl, livestock (grazing), recreational pollution sources, wildlife other than waterfowl, road/bridge runoff, and streambank modification or destabilization.

The proposed Project segments are located on the Carson National Forest and the primary land uses have been livestock grazing and recreation, with historic logging. Grazing in the riparian corridor has impacted the growth and regeneration of native woody species, influencing both shade coverage through reducing the overstory canopy and bank stability by a reduction in root mass[2]. Having overstory canopy on the stream banks is important in maintaining water temperature within the acceptable range, especially during the summer months when solar exposure is most severe. Root mass in the banks and downed large woody debris within the channel reduce widening of the channel and promote complex pool formation, characteristics that both lead to lessened solar exposure and also contribute to higher dissolved oxygen (DO) content. More dissolved oxygen can be held in cold water compared to warm water.

The 2004 Total Maximum Daily Load (TMDL) for the Upper Rio Grande Watershed[3], which includes the Rio San Antonio, indicates that temperature data collected from 2002 and 2003 exceeded HQCWAL criteria 255 of 1,446 times (18%), with a maximum recorded temperature of 27.1°C. The summer of 2003 exceeded HQCWAL criterion 350 of 1,446 times (24%) with a maximum daily temperature of 27.6°C. The TMDL states that the Rio San Antonio exceeds the solar loading allocation at a rate of 127.82 j/m²/s, needing to be reduced from its current 275.30 j/m²/s to 147.48 j/m²/s to meet the HQCWAL water quality standard. To achieve this reduction, the TMDL suggest the current canopy cover of 16.0% will need to be increased to approximately 55%. The Rio San Antonio has no point sources for temperature, therefore the load reduction goals must be met through addressing nonpoint sources of temperature pollution. The WBP identifies cattle and wild ungulate grazing, which has reduced riparian vegetation and led to increased bank erosion resulting in channel widening, as the primary nonpoint source of pollution that affects water temperature through increased solar loading. The width to depth ratio is high in the Rio San Antonio and channel depth and riffle/pool complexity is low.

EPA funding under Section 319 of the Clean Water Act provides resources to implement activities described in the *Rio San Antonio Water Quality Improvement Project* (2017) work plan. The work plan states, “The primary goals of the Project have been designed to reduce solar energy loading, re-establish and protect riparian vegetation in denuded reaches, stabilize eroded streambanks and decrease the width to depth ratio, and reduce impacts of livestock and grazing ungulates that are currently contributing to surface water quality exceedances on Rio San Antonio watershed. This will be accomplished by 1) increasing and protecting mid-story and overstory riparian canopy cover throughout the project area floodplain and subsequently reducing the width to depth ratio of the stream; 2) placing in-stream structures (e.g., post vanes, weirs, baffles, and Zuni bowls) to create deep pools and decrease the width to depth ratio, stabilizing eroded streambanks, and promoting bank formation; 3) constructing a water catchment in the associated upland to deter, cattle and elk from watering on the Rio San Antonio; and 4) restoring wet meadow habitat to increase bank and floodplain water storage capacity and increase flows

[1] https://www.env.nm.gov/swqb/303d-305b/2016-2018/documents/EPA-APPROVED2016APPA--IntegratedList.pdf
[2] https://www.env.nm.gov/swqb/wps/WBP/Accepted/San%20Antonio/San_Antonio_WBP_4-29-2016_accepted.pdf
[3] https://www.env.nm.gov/swqb/documents/swqbdocs/MAS/TMDLs/URG/2004/URGPt1TMDLs-2004.pdf

throughout the low-flow season. Native woody riparian vegetation will be planted throughout the project corridor where needed and will provide direct shade over the stream surface. The increase in riparian vegetation shading will help alleviate solar loading, thereby moderating and reducing water temperatures.

Objective

The goals of the Rio San Antonio Water Quality Improvement Project are to monitor and evaluate the effectiveness of the restoration projects in the Rio San Antonio watershed, which have been designed to reduce stream temperature by increasing riparian vegetation shading throughout the project reach, reducing the stream width-to-depth ratio, reducing erosion, and improve channel stability. Monitoring these resultant changes within the project reach will be addressed by the following monitoring methodologies:

1. Monitoring changes in stream canopy cover shading toward the goal of increasing the estimated 16.0% existing cover[4] to 55% (NMED 2004);
2. Monitoring the survival success of planted woody riparian vegetation to aid in the formulation of adaptive management measures (Matison and Ham 2013);
3. Establishing permanent photo point locations to visually and qualitatively monitor changes to the stream and riparian system (Zeedyk and Clothier 2009);
4. Installing thermographs above and below the project area to directly monitor water temperature (NMED 2016b);
5. Modeling heat transport using the Stream Segment Temperature Model Software (SSTEMP; Bartholow 2010); and
6. Monitoring changes in stream geomorphology and bottom deposits by installing and measuring permanent stream cross-sections, pebble counts, and longitudinal profiles (NMED 2016c).

1.4 Project/Task Description

Description

The Rio San Antonio Water Quality Improvement Project will collect data by establishing baseline conditions and monitoring post-implementation changes to evaluate the success of the restoration projects and to apply ongoing adaptive management techniques throughout the project duration.

Schedule

Monitoring is planned for two years, beginning with baseline data collection in 2019, and continuing through post implementation monitoring in 2020. Long-term deployment of thermographs will be conducted over the same period each year, between May and September, to capture maximum daily temperatures for 2019 and 2020. Specific metrics and corresponding methods are described in Table 2. Data will be examined each year to determine the effects of the project on water quality, with the understanding that some effects may take longer to detect due to the lag time of vegetation growth rates and ecological response. Because of this, permanent photo points will be established Spring 2019 to document visual changes in vegetation within the Rio San Antonio project area.

Table 2.
Schedule of Metrics and Methods

Metric/Methods	Spring 2019	Summer/Fall 2019	Summer/Fall 2020
1. Stream Canopy Cover: Densiometer measurements will be taken to measure pre- and post-project	**X**	**X**	**X**

[4] Total Maximum Daily Load (TMDL) for the Upper Rio Grande Watershed (Part 1)

vegetation shading of the stream surface. Data collection methodology will be done in accordance with the Percent Canopy Cover section in the *2016* NMED/SWQB Standard Operating Procedures (SOP) for Physical Habitat Measurements (NMED/SWQB 2016c).			
2. Planted Woody Vegetation Survival: Vegetation Circle Plots will be established and live and dead woody stems of existing and planted vegetation will be counted to determine survival. Methodology will follow that developed by Ham and Matison (2013).	**X**	**X**	**X**
3. Visual Stream and Riparian Condition: Permanent photo points will be established throughout the project reach prior to project implementation and monitored during the growing season through and following project completion. Methodology will be done in accordance with Zeedyk and Clothier (2009).	**X**	**X**	**X**
4. Stream Temperature: Stream temperature data loggers will be installed above and below the project corridor to measure daily temperature extremes. Data collection methodology will be done in accordance with that presented in the Step-by-Step Process Description section of the NMED/SWQB SOP 6.3 for Temperature Dataloggers (Thermographs*) (*NMED/SWQB 2016b).		**X**	**X**
5. SSTEMP Temperature Modeling: Heat transport modeling will be completed by employing SSTEMP Software and inputting data values collected in the field to help predict project consequences on stream temperature. Methodology will be done in accordance with that of Bartholow, J. (2010).			**X**
6. **Stream Morphology:** Cross-sectional, longitudinal profiles, and pebble-count surveys will be established and monitored before, during, and post-project at selected areas throughout the project reach (6 cross sections and 3 longitudinal profiles). Methodology will be done in accordance with 2016 NMED/SWQB Standard Operating Procedures for Physical Habitat Measurements, SOP 5.0 (NMED/SWQB 2016c).	**X**		**X**

Location

The project area is in the Rio San Antonio watershed on the Carson National Forest (Figure 2).

Table 3
Rio San Antonio Effectiveness Monitoring Stations

Station	Description/Rationale	Latitude and Longitude	Previous Data
RSA – UPPR4	Upper Rio San Antonio above Project Area	N 36.878642 W -106.241018	Yes
RSA – UPPR3	Upper Rio San Antonio below Project Area	N 36.856259 W -106.186096	Yes

The stations identified in Table 3 have been selected to monitor and evaluate the effectiveness of the restoration projects in the Rio San Antonio watershed, these same stations were also utilized during the development of the Rio San Antonio WBP. Additional stations may be added in the future based on the experience and professional judgment of the WildEarth Guardians Restoration Project Director and the

monitoring Contractor (Timberline Environmental) to best evaluate and determine the effectiveness of restoration implementation locations. Additional locations may include stations for canopy cover, geomorphology, and photopoint monitoring. The data will all be collected in accordance with the procedure stated in this QAPP.

Table 4
Waterbody Attributes for the Rio San Antonio

Waterbody	Assessment Unit Name	Assessment Unit ID	8 digit HUC name	12-digit HUC	12-digit HUC Name
Rio San Antonio	Rio San Antonio – Montoya Canyon to headwaters, 17.92 miles; AU: NM-2120.A_901	NM-2120.A_901	Conejos River	130100050301	Upper Rio San Antonio

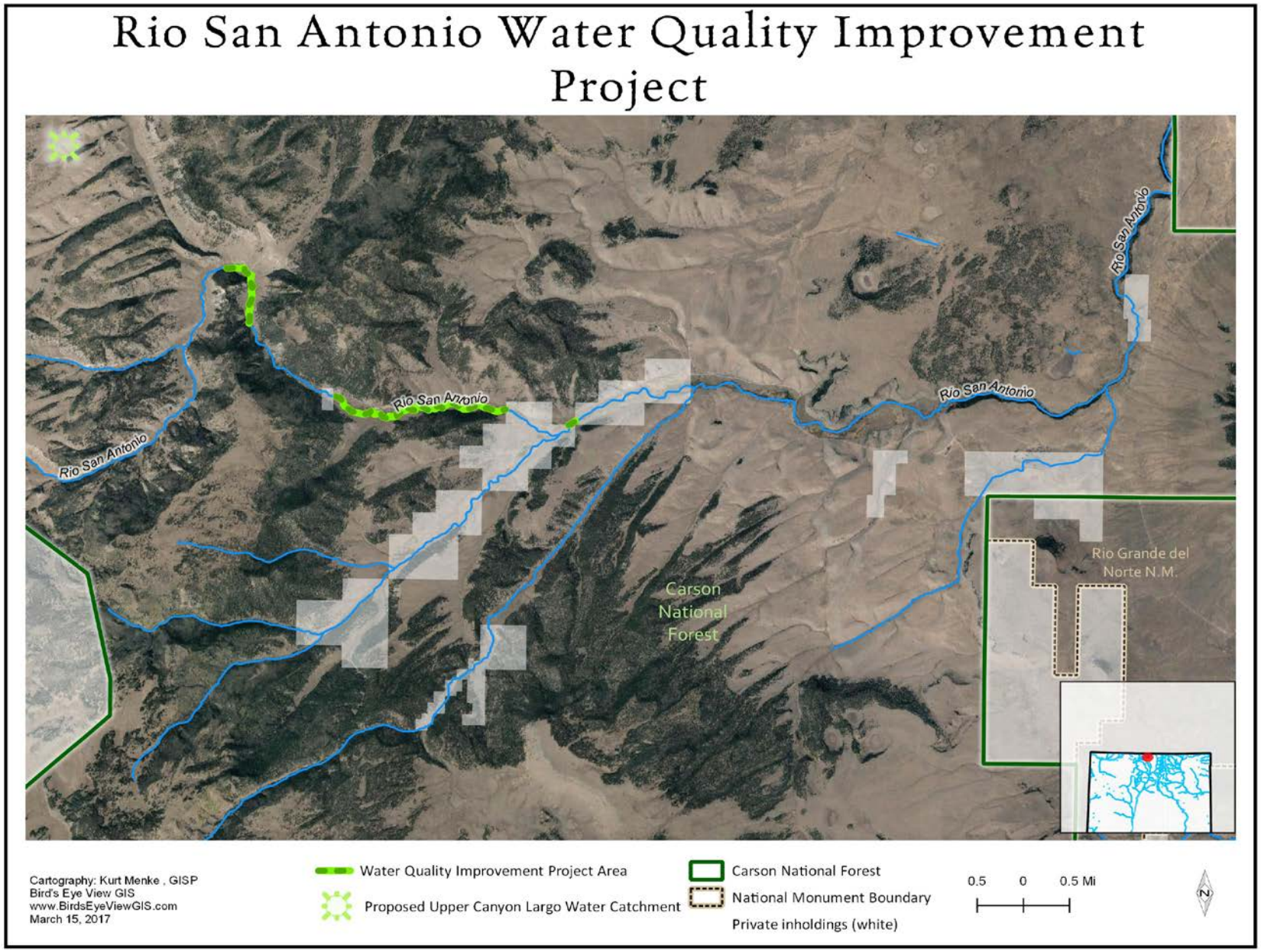

Rio San Antonio Water Quality Improvement Project
Rio San Antonio
Rio San Antonio
Rio San Antonio
Rio San Antonio
Carson National Forest
Rio Grande del Norte N.M.
Cartography: Kurt Menke , GISP
Bird's Eye View GIS
www.BirdsEyeViewGIS.com
March 15, 2017
Water Quality Improvement Project Area
Proposed Upper Canyon Largo Water Catchment
Carson National Forest
National Monument Boundary
Private inholdings (white)
0.5 0 0.5 Mi
N

Figure 2

1.5 Quality Objectives and Criteria for Measurement Data

Question/Decision

The Rio San Antonio Project is intended to answer the following question: Have the restoration activities in the Upper Rio San Antonio watershed lowered water temperatures on the Rio San Antonio?

Stated as a decision: The information gathered by the Rio San Antonio Water Quality Improvement Project will be used to decide whether the restoration activities in the Rio San Antonio watershed have lowered water temperatures and alleviated solar loading. Both qualitative and quantitative data will be collected, and where applicable modeled in SSTEMP and/or statistical software to determine if goals are being achieved.

Data Quality Objective (DQO)

The quality of the data will be adequate to provide a high level of confidence in determining whether the restoration activities in the Upper Rio San Antonio watershed have lowered water temperature on Rio San Antonio.

Measurement Quality Indicators

The measurement quality objectives will be sufficient to achieve the Data Quality Objective (DQO) and will be in conformance with those listed in the this QAPP. The Data Quality Indicators listed in the SWQB's QAPP (NMED/SWQB 2016a) and applicable to the data collected for this project are precision, bias, accuracy, representativeness, comparability, completeness, and sensitivity.

DQI	Determination Methodologies
Precision	In order to increase precision of data collection in the field, a minimum of two field staff will be present during all data collection activities to ensure adherence to this QAPP and referenced methods. Ideally, to assure consistency and thereby precision, the same personnel will carry out the responsibilities of collecting, recording and analyzing data
Bias	Bias will be reduced by using professional and experienced staff to collect and analyze data
Accuracy	The basis for determining accuracy will be based on the sensitivity of the field equipment and the staff's expertise of the survey method for collecting data and ensuring the accuracy of the equipment being used is within the acceptable range of a particular survey
Representative	Data collection will be representative of the project area specifically pre- and post-restoration areas.
Comparability	The data collected both before and after implementation of the workplan will be collected using the same methods in order to be comparable and ascertain the effectiveness of the project. In addition, the methods used for this project are similar to those used in other restoration projects with established quality assurance mechanisms for comparability so that results of this project may be comparable with other studies of a similar nature.
Completeness	Data collection will include all parameters at each field survey to ensure completeness and usability of the data.
Sensitivity	Sensitivity is ensured based on the manufacturer's specified range and accuracy of the equipment being used and the expertise of the field staff to use and apply data collection methods in a manner that minimizes subjectivity or gross data collection errors.

1.6 Special Training/Certification

This project will be primarily implemented by Jim Matison (Restoration Project Director) of WildEarth Guardians and monitoring overseen by The Monitoring Contractor of Timberline Environmental LLC. Project staff responsible for data collection are responsible for following the requirements identified in the QAPP for specified data collection methodology. Monitoring will be carried out by The Monitoring Contractor (Jeffery Ham) of Timberline Environmental LLC, with technical support provided by Dan Guevara (SWQB). No special training/certification is required.

Jim Matison has a B.S. from the University of Arizona and has been the Restoration Director for WildEarth Guardians for the last 13 years. Jim has provided project management and implementation for eight previous CWA 319 funded projects in New Mexico, as well as six New Mexico funded Riparian Ecosystem Restoration Initiative (RERI) projects, seven USFWS Partners and NAWCA projects, and more than half a dozen of privately funded restoration projects. WildEarth Guardians and Jim have also participated in additional CWA 319 and RERI projects as a sub-contractor.

Jeffrey Ham received a B.S. in Biology from Fort Lewis College and has collaborated with WildEarth Guardians and other ecological restoration practitioners on projects throughout the southwest for the past 10 years. Jeffrey has been involved with implementation and monitoring activities on over 15 riparian and wetland restoration projects throughout New Mexico, Colorado, and Arizona, and is currently completing monitoring for the Rio de las Vacas Watershed Based Plan.

1.7 Documents and Records

The Project Officer will make copies of this approved QAPP and any subsequent revisions available to all individuals on the distribution list who do not have signature authority for approving the QAPP.

When changes affect the scope, implementation, or assessment of the outcome, this QAPP will be revised to keep project information current. The Project Officer, with the assistance of the QAO, will determine the effects of any changes to the scope, implementation, or assessment of the outcome on the technical and quality objectives of the project. This Project Plan will be reviewed annually by the SWQB Project Officer to determine the need for revision.

All field sheets will be verified before leaving the field, any data captured on a global positioning system (GPS), camera, smart phone, tablet, or laptop will be downloaded to a WildEarth Guardians computer or an external hard drive at the end of each day.

All project documents including this QAPP, signed acknowledgement statements, protocol documents, field notebooks, calibration records, validation and verification records, recorded field data, in hard copy or in electronic form, and QC records will be maintained, and protected by the WildEarth Guardians Project Director. A copy will be made of all data and stored separately from the original data to ensure the integrity of the raw data set. WildEarth Guardians Restoration Project Director will also prepare and maintain copies of project interim and final reports. All raw data, project documents and reports will be submitted quarterly to the SWQB 319 Project Officer by WildEarth Guardians Restoration Project Director.

The QAPP, signed QAPP acknowledgement statements, project documents and all reports will be maintained by the SWQB Project Officer in the project file at the SWQB in Santa Fe, NM.

2.0 DATA GENERATION AND ACQUISITION

2.1 Sampling Design

Baseline temperature data will be collected prior to project implementation, throughout project implementation, and post-project completion. Baseline temperature data will be used in SSTEMP to refine model parameters and define solar loading reductions necessary to meet the surface water quality standard for temperature.

Two thermographs will be deployed concurrently, one upstream of monitoring station RSA – UPPR4, and one downstream of monitoring station RSA – UPPR3 (see Table 3 for monitoring station location details). Additional thermograph monitoring stations may be added before restoration implementation based on the experience and professional judgment of the WildEarth Guardians Restoration Project Director or The Monitoring Contractor. Long-term deployment of thermographs will occur during the same period (May through September) of each monitoring year to construct a continuous record of stream temperature during the warm period to identify diurnal fluctuations with special emphasis on the daily maximum. Thermographs will be installed within +/- 500m of locations identified in Table 3. Installation will occur at location that are representative of ambient stream conditions, generally in the transition between a riffle/run and a pool, or at the toe of a pool, rather than in shallow riffles or deep pools.

Monitoring locations identified in Table 3 will be used as SSTEMP sites, supplemental monitoring locations may be added during the restoration implementation for further analysis of stream temperature with SSTEMP. Channel geometry (cross-sectional survey and longitudinal profile) and percent canopy cover measurements will be collected at all SSTEMP sites to enhance model output. These parameters will be collected at least once pre- and post-implementation. Data will not be collected immediately following events that cause visible changes to channel geomorphology, such as a large flood or scour event.

Stream morphology surveys (cross-sectional, longitudinal profiles, and pebble-count surveys) will be conducted before, during, and post-project implementation at selected areas where restoration implementation intends to stabilize eroded streambanks and decrease width to depth ratio within the Rio San Antonio project area. Exact location will be determined in the field by the WildEarth Guardians Restoration Project Director or The Monitoring Contractor and are dependent of restoration implementation locations.

Percent canopy cover, through the use of a spherical densiometer, will be conducted in conjunction with stream morphology surveys and at SSTEMP sties. Densiometer readings will measure percent shade over the stream surface and will be used to compare pre- and post-project conditions, and whether the project is achieving reductions in solar radiation reaching the stream surface.

Baseline woody vegetation data will be collected prior to project implementation and post-project completion to monitor survival of planted woody vegetation by counting live and dead woody stems within numerous permanent 25-foot diameter circular plots dispersed throughout each planting area. The 25-foot diameter circular plots will be established in known planting areas before planting occurs.

Permanent photo point locations will be established at SSTEMP sites, stream morphology survey location and at each planting area. Photo documentation will occur pre-project implementation and post-project completion. Azimuth, elevational readings and GPS coordinates will be taken during initial permanent photo point establishment to ensure repeat photo observations are recreated accurately, if possible photo point location will be monumented with capped rebar (or similar). Photo points will be used to capture changes over time at permanent photo point locations. Metadata associated with photo documentation will include date, time, azimuth, elevation, GPS coordinates, weather, precipitation totals over past 60 days, photographer as well as any remarkable notes.

2.2 Sampling Methods

All data collected will be done in accordance with this QAPP, SWQB SOPs and the procedures listed in the Sampling Methods section of this QAPP.

Specifics sampling methodologies for each monitored parameter are provided below:

1. **Stream Temperature** data will be collected using the HOBO® Water Temp Pro v2 thermograph and the HOBOware Pro® software in accordance with all applicable procedures presented in Section 6.0 Step-by-Step Process Description of the NMED/SWQB Standard Operating Procedures for "Thermographs", SOP 6.3 *(*NMED/SWQB 2016b*).* Data will be evaluated using the SSTEMP model.

2. **Stream Morphology** cross-sectional data, longitudinal profiles and pebble-count will be collected using 2016 NMED/SWQB Standard Operating Procedures for Physical Habitat Measurements*,* SOP 5.0 (NMED/SWQB 2016c) to determine the channel geometry input parameters for SSTEMP.

3. **Stream Percent Canopy Cover** spherical densiometer measurement points will be collected using a modified methodology from the Percent Canopy Cover section of the 2016 NMED/SWQB Standard Operating Procedures for Physical Habitat Measurements, SOP 5.0 (NMED/SWQB 2016c). Modification to the SOP include only evaluating canopy cover at the implementation locations rather than a full transect as described in the SOP. Canopy cover data will be evaluated to determine if there was an increase in cover within the implementation area.

4. **Planted Woody Vegetation Survival** will be monitored by tabulating all woody stems for each planted species located within the circular plot as either live or dead, which will derive percentage survival. Methodology follows Ham and Matison (2013).

5. **Visual Stream and Riparian Condition** photo documentation will be collected at permanent photo point locations in accordance with protocols established by Zeedyk and Clothier (2009), Appendix I, Outline for Photographic Monitoring.

6. **SSTEMP Temperature Modeling** will use thermograph values, stream morphology values and densiometer values from SSTEMP monitoring location. These data values from stated parameters will be used in SSTEMP to refine model parameters and define solar loading reductions necessary to meet the surface water quality standard for temperature.

2.3 Sample Handling and Custody

Because there are no plans to collect water or soil samples for laboratory analysis, there is no handling requirements.

2.4 Analytical Methods

Because there are no plans to collect water samples, no analytical methods are needed.

2.5 Quality Control

For this project, the QC activities are those needed to assess and demonstrate the reliability of the data. The quality of the data is controlled by using standardized methods that are documented in this QAPP.

All personnel who collect, manage or manipulate data will be familiar with and implement the procedures identified in this QAPP.

Temperature quality control will be assured by verifying deployment locations are well submerged and not subject to erroneous air temperature readings. Loggers will also be checked for accuracy prior to deployment, and retrieval from the field as described in the NMED/SWQB Standard Operating Procedures for "Thermographs", SOP 6.3 (NMED/SWQB 2016b*)*.

The chief source of data is measurements of temperature made using thermograph dataloggers. The QC activities relating to thermograph measurements are described in Sections 2.6 and 2.7 below. Control limits and descriptions of corrective actions for thermographs are found in the NMED/SWQB's SOP for Thermographs (NMED/SWQB 2016b).

Stream morphology surveys will demonstrate quality control by following all procedure identified in 2016 NMED/SWQB Standard Operating Procedures for Physical Habitat Measurements, SOP 5.0 (NMED/SWQB 2016c). Personnel will complete all portions of procedures identified for conducting cross-sectional surveys, longitudinal profiles and pebble counts.

Canopy coverage has the greatest potential for observer error and bias. Quality control will be strengthened by following the procedures described in 2016 NMED/SWQB Standard Operating Procedures for Physical Habitat Measurements, SOP 5.0 (NMED/SWQB 2016c) and having the same observer take measurements at each location. This reduces the bias affect and increases the precision of each measurement.

Monitoring vegetation survivorship will be done in accordance with (Matison and Ham 2013), and photo-points measurements will be conducted according to (Zeedyk and Clothier 2009). These procedures are considered adequate in satisfying the quality assurance requirements for this project.

2.6 Instrument/Equipment Testing, Inspection and Maintenance

The primary equipment needing maintenance, testing and inspection are temperature data loggers and the equipment used for stream morphology surveys. Requirements and procedures are specified in the NMED/SWQB SOP for Thermograph for temperature data loggers (NMED/SWQB 2016b). HOBO® Water Temp Pro v2 dataloggers (Onset Computer Corporation) will be deployed and data downloaded and managed in HOBOware Pro® software. Stream morphology equipment (spherical densiometer, measuring tape, ruler, clinometer, survey rod, flow meter etc.) will be tested and maintained according to manufacture specification. Stream morphology equipment will be inspected prior to use by either the WildEarth Guardians Restoration Project Director or the Monitoring Contractor.

2.7 Instrument/Equipment Calibration and Frequency

It should be possible to show that all data was collected with monitoring devices that can be shown to have been properly calibrated. Calibration requirements, methods and standards, and procedures for the maintenance of calibration records are specified in the SWQB SOPs. For this project, Hobo Water Temp Pro V2 data loggers will be tested for accuracy before and after each field season in accordance with Thermograph Calibration Verification section of the NMED /SWQB SOP for Thermographs (NMED 2016).

2.8 Inspection/Acceptance of Supplies and Consumables

There are no plans to use consumables in the calibration of thermographs.

2.9 Non-direct Measurements

There are no plans to use data from non-direct measurement sources.

2.10 Data Management

Field data, such as densiometer measurements, cross-sectional, longitudinal profiles, and pebble-count survey data will be recorded on field sheets and field notebooks. These data will be checked for completeness (no missing data fields) by the WildEarth Guardians Restoration Project Director or the Monitoring Contractor before leaving the site, immediately scanned upon return from the field. All Electronic data including scanned documents will be transferred from laptops, cameras, thermographs, and GPS units to the WildEarth Guardians server, which will be backed up daily. Once data has been transferred to WildEarth Guardians servers, data will also be transferred to SWQB Project Officer. NMED SWQB will back up all transferred data for redundancy. NMED SWQB will maintain the data in SWQB Network Drive, which has limited access to only SWQB Staff and Managers and is regularly backed-up and secure.

3.0 ASSESSMENT AND OVERSIGHT

3.1 Assessment and Response Actions

Assessments and response actions will be reported as described below in 3.2. The SWQB Project Officer will provide project oversight by periodically assisting with and/or reviewing data collection efforts, twice per year during the life of the project. The Project Officer will assess project progress to ensure the QAPP is being implemented, including periodic audits by the QAO, as needed. Any problems encountered during the course of this project will be immediately reported to the Project Officer who will consult with appropriate individuals to determine appropriate action. Should the corrective action impact the project or data quality, the Project Officer will alert the QAO. If it is discovered that monitoring methodologies must deviate from the approved QAPP, a revised QAPP must be approved before work can be continued. All problems and adjustments to the project plan will be documented in the project file and included in the final report.

3.2 Reports to Management

Quarterly reports are submitted by the WildEarth Guardians to the SWQB Project Officer and include progress of project implementation and any available data. Printouts, status reports or special reports for SWQB or EPA will be prepared upon request including pollutant load reduction calculations. Separate annual monitoring reports will also be provided and included in the final report. The SWQB Project Officer will be responsible for maintaining project progress in the EPA Grants Reporting and Tracking System and final report, and all other required project deliverables to be submitted to the EPA under this grant.

4.0 DATA VALIDATION AND USABILITY

4.1 Data Review, Verification and Validation

Data, whether collected by SWQB or others, will be considered usable if it has been collected in accordance with this QAPP and confirmed through verification and validation procedures. The Restoration Project Director will complete and document the findings of the verification and validation procedures. The QAO is responsible for determining if the data was collected according to this QAPP and meets quality assurance requirements.

4.2 Verification and Validation Methods

Project data will be verified and validated according to the procedures described in the most current SWQB Verification and Validation SOP (https:/www.env.nm.gov/surface-water-quality/sop/). Verification and validation issues will be resolved by the Project Coordinator and the QAO. Results of the validation process will be conveyed using validation and verification worksheets (Appendix 6.1).

Verification issues include the completeness of the record, and verification of calibration. Validation issues include the review of the data for anomalous data points and removal of data points based on reasonable explanation.

4.3 Reconciliation with User Requirements

The data, if collected in accordance with this QAPP, will provide a high level of confidence in deciding whether the restoration activities in the Rio San Antonio watershed have lowered water temperatures on Rio San Antonio.

If project results do not meet this requirement, then additional monitoring may be necessary to fill in data gaps or it may be necessary to extend the monitoring period to measure effects that were not apparent during the project period.

5.0 REFERENCES

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6.0 APPENDIX

6.1 Data Verification Worksheet

Name and Date of Data Record	Complete Record [Y/N]	Instrument in working order [Y/N]	Checked for anomalous data [Y/N]	Verified by [name of reviewer]	Verified on [Date]

6.2 Acknowledgement Statement

New Mexico Environment Department Surface Water Quality Bureau

Rio San Antonio Water Quality Improvement Project
Quality Assurance Project Plan
Acknowledgement Statement

This is to acknowledge that I have received a copy (in hard copy or electronic format) of the Rio San Antonio Water Quality Improvement Project *Quality Assurance Project Plan*.

As indicated by my signature below, I understand and acknowledge that it is my responsibility to read, understand, become familiar with and comply with the information provided in the document to the best of my ability.

_____

Signature

_____

Name (Please Print)

_____

Date

Return to SWQB Project Officer (Alan Klatt)